

# 2018 MISSOURI DROUGHT

## BY THE NUMBERS



Missouri's drought of 2018 was notable in its localized intensities and impacts to both agriculture and public water supplies. However, the 2018 Drought should be remembered for its response. Governor Parson and his cabinet quickly responded with coordinated and effective resources. Agency staff worked tirelessly as a team with a goal of getting help to those who needed it most. Seamless communication aided in the effective response. Communications staff from state agencies worked to ensure clear, coordinated information was communicated to the public.

# \$8,153,942

Amount of assistance committed to landowners by the Soil and Water Conservation Program

Percent of the state that experienced dry to exceptional drought conditions at the peak of the 2018 Drought

# 86

Number of counties in severe to exceptional drought at the peak of the 2018 Drought

# 1 MILLION

Drought interactions on social media sites

# 98

# 33

Number of Conservation Area (28) and State Park (5) accesses made available for free water withdrawal by agriculture producers

# \$912,568 AND \$2,678,608

Amount of assistance committed to eligible public drinking water projects by the Financial Assistance Center and Department of Economic Development's Community Development Block Grants, respectively

# 271,679

Number of Twitter Impressions for 2018 Drought

# 1,374

Acres available for emergency haying access at Missouri State Parks (900) and Conservation Areas (474)

Acres made available for emergency haying under the USDA-NRCS Wetland Reserve Easement Program

# 15,000

Potential acres of cover crop funded through Emergency USDA-NRCS Environmental Quality Incentive Program

# 634,106

# 66,000

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## 2018 Drought Response Final Report

Missouri's drought of 2018 was notable in its localized intensities and its overall impacts to both agriculture and public water supplies. Abnormally dry conditions extended through fall and winter 2017, with dry conditions re-emerging in late spring 2018.

Missouri's Drought Response Plan includes a progression of drought response actions commencing with the formation of a Climate and Weather Committee to monitor climatic conditions as drought emerges. For the 2018 drought, the Climate and Weather Committee first met Jan. 29, 2018, to discuss the dry conditions observed during fall 2017 (Fig. 1). Discussion also centered on early preparedness, should the drought remain as the growing season began.

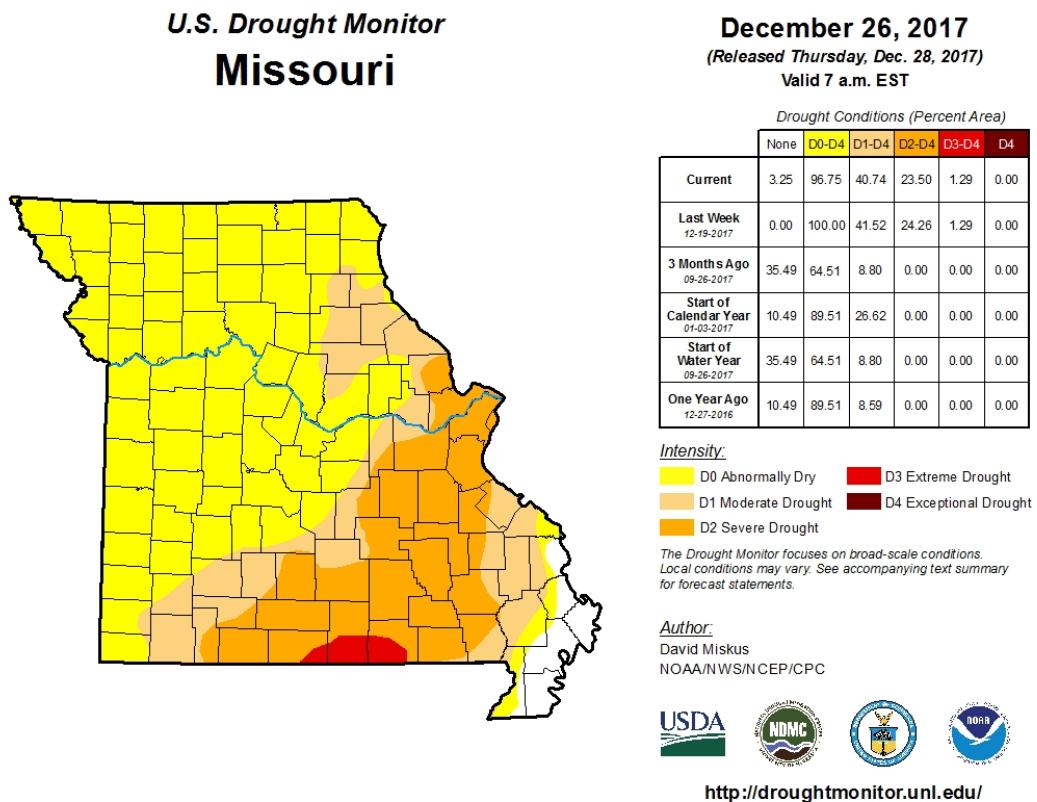
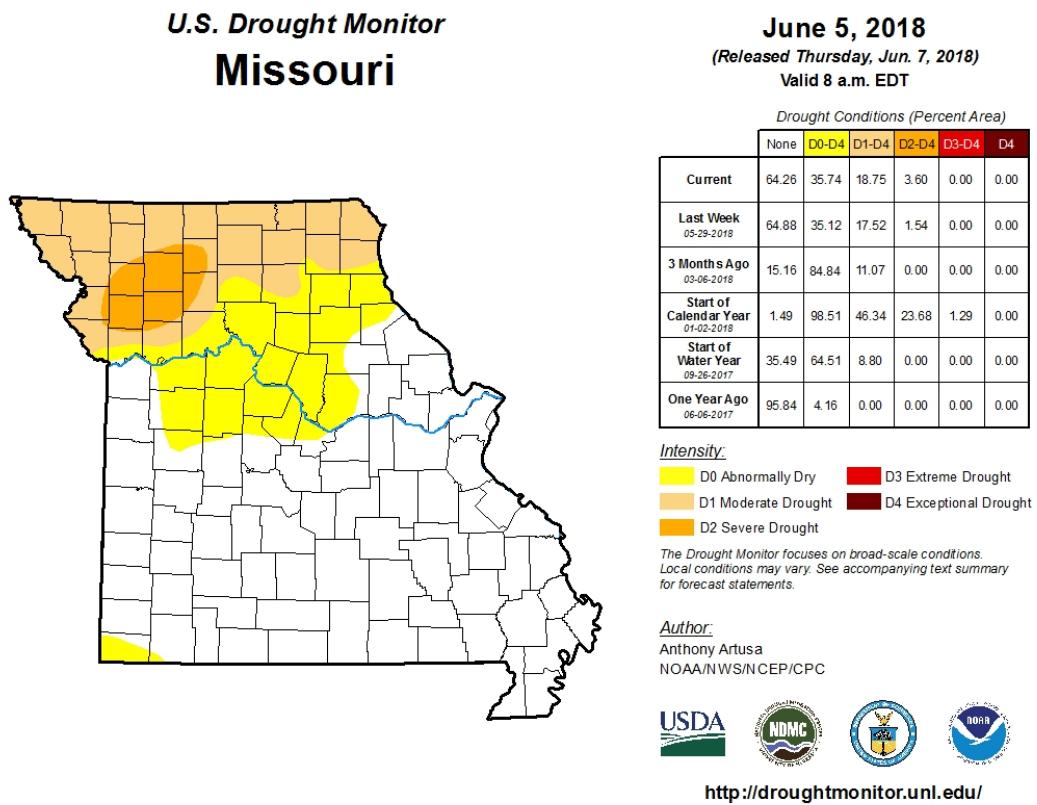


Figure 1. Missouri Drought Monitor Map for Dec. 26, 2017.

Subsequent to the January meeting, early spring rains alleviated drought concerns. Additionally, the state saw its second coldest April on record ([climate.missouri.edu/news/arc/may2018.php](http://climate.missouri.edu/news/arc/may2018.php)). The mild spring initially painted a more positive drought picture, however, it quickly became evident the cold April temperatures would add to agricultural impacts as a hot, dry May followed. State Climatologist, Pat Guinan, recorded in the May 2018 climate summary, "Record May warmth impacted Missouri with preliminary data indicating a statewide average temperature of 72.5°F, or 8.2 degrees above the long-term average. The unprecedented warmth eclipsed the prior record established in 1962. ... The extreme flip in monthly temperature anomalies, from 2nd coldest April to 1st warmest May, was nothing short of incredible. Missouri

experienced a spring where April behaved more like March and May was typical of June. The last time a flip in extreme temperature anomalies for consecutive months occurred in Missouri was December 1989 (3rd coldest) to January 1990 (3rd warmest)."

Livestock producer impacts were some of the first to become apparent. Pastures already stressed from a drier than normal fall in 2017, were stunted by the large 2-month temperature swing and continued dry weather. The Climate and Weather Committee reconvened June 7, 2018, as a result of continued declination. Though the national drought monitor map indicated much of the state was free of drought (Fig. 2), the committee determined that continued hot and dry climatic conditions could lead to rapid deterioration in conditions. The committee agreed to reconvene in one month to assess and recommend further action, if needed.



**Figure 2. Missouri Drought Monitor Map for June 5, 2018.**

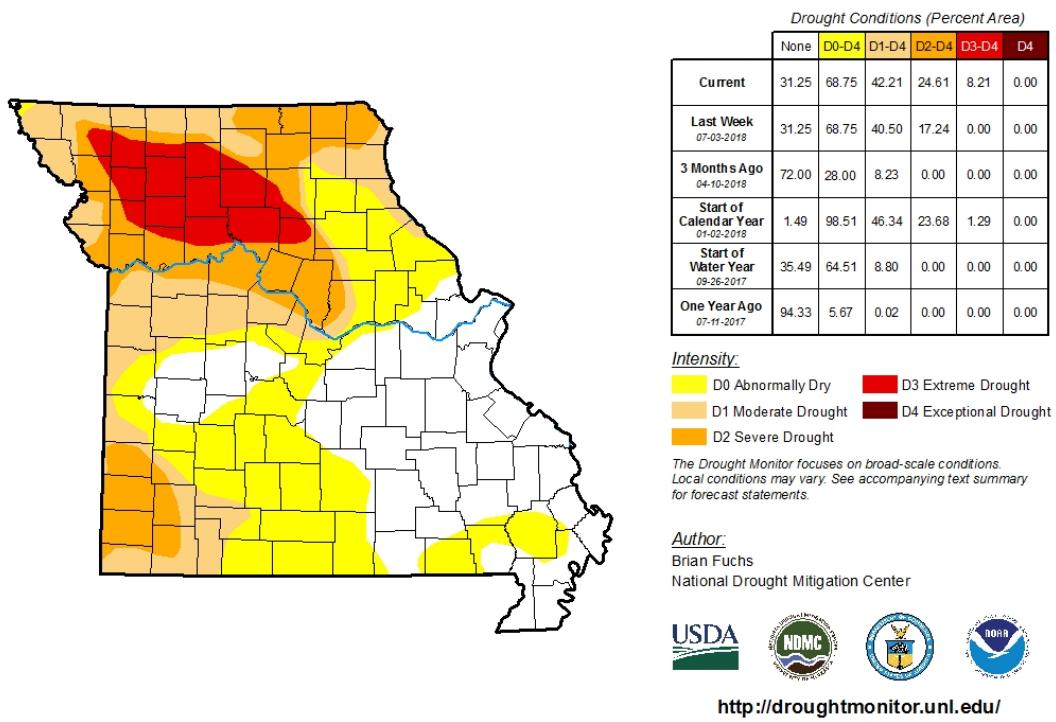
The Climate and Weather Committee met July 13, 2018. Conditions had deteriorated, with a large area of northern Missouri experiencing drought conditions. Extreme (D3) conditions had emerged from Nodaway County in the northwest, south to Clinton County, and east to Randolph and Macon counties (Fig. 3). The outcome of the July meeting was a recommendation by the committee for the state to enter the next phase of drought response to include a request for Governor Michael L. Parson to issue an Executive Order declaring a drought alert in affected areas of the state.

**U.S. Drought Monitor**  
**Missouri**

**July 10, 2018**

(Released Thursday, Jul. 12, 2018)

Valid 8 a.m. EDT



**Figure 3. Missouri Drought Monitor Map for July 10, 2018.**

The Governor issued Executive Order 18-05 July 18, 2018. The Executive Order declared a drought alert for all counties currently experiencing severe, extreme or exceptional drought (D2-D4). As counties entered D2 and greater, they would be considered in drought alert through the duration of the executive order (Dec. 1, 2018). The Executive Order further directed the Department of Natural Resources to activate and designate a chairperson for the Drought Assessment Committee and requested all Missouri and federal agencies participate as needed. All state agencies were further directed to examine how they could assist affected communities, as well as those communities that may be affected in the future. Assistance was provided through temporary suspension of administrative rules, appropriation, or other means of support to mitigate the effects of the drought conditions.

The first meeting of the Drought Assessment Committee (DAC) convened July 26, 2018. The DAC included membership from federal and state agencies, the University of Missouri, and regional planning commissions. In addition, the Department of Natural Resources created a series of webpages for drought-related news and information to better facilitate communication, coordination, and delivery of resources to those impacted by drought ([dnr.mo.gov/drought.htm](http://dnr.mo.gov/drought.htm)). The objectives of the first DAC meeting were to provide members with background information about the climatic conditions that led to development of the drought and to share initial resources available to those already being impacted by drought. Guinan announced the creation of a Missouri-specific Drought Impact Reporter that could be used by any citizen to report impacts they were observing. Use of the impact reporter would reflect severity of drought and would help

decision-makers get resources where they were needed. In total, Missourians submitted 1,488 reports between May 11 and October 23, 2018. Nearly 200 photos accompanied the reports.

Two Impact Teams, focusing specifically on impacts for agriculture and public water supplies, also convened. The Impact Teams gathered and shared information with the DAC at subsequent meetings. The Agriculture Impact Team met twice, August 2 and 16, and the Water Supply Impact Team met once during the 2018 drought, August 1. Full membership rosters of the DAC and both Impact Teams are included as attachments.

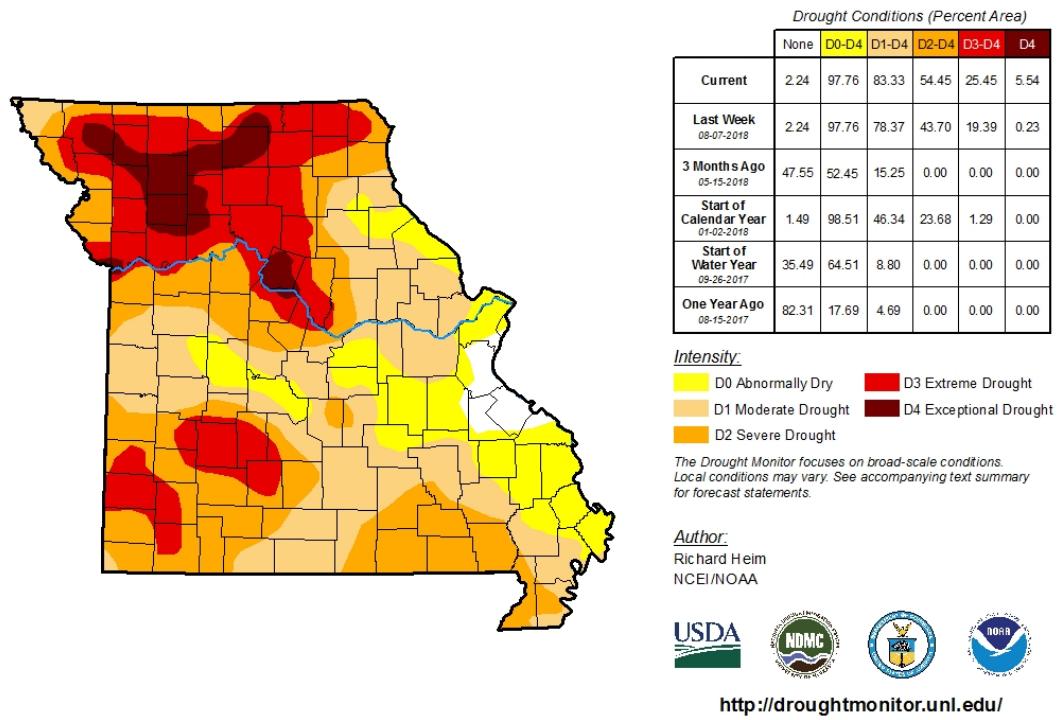
With drought conditions continuing to spread and the need to continue to coordinate resources, the DAC reconvened Aug. 8, 2018. Impacts were being widely felt by both agricultural producers and public water supplies in the areas of the state experiencing drought. Fifty-one counties in Missouri were experiencing D2 drought or greater and nearly 95 percent of the state was experiencing at least abnormally dry conditions. Missouri Department of Transportation announced it would issue an over-width blanket permit to aid in transportation of hay throughout the state. The permit would be at no cost to transporters. Additionally, DAC members heard and shared updates about agriculture and public drinking water resources being made available. Detailed reports about the resources made available during the 2018 drought are included as attachments. Three water supplies – Cameron, Hamilton and Milan – were highlighted during discussion because they could require emergency action if drought continued to persist. The DAC expressed a need to contemplate innovative ways to provide forage and water for livestock producers.

In response to information discussed during the DAC meeting, Governor Parson announced on Aug. 20, 2018, the availability of additional water and hay opportunities. Water for family farms was made available at 28 Department of Conservation areas and five Department of Natural Resources state parks. The creation of a hay lottery also was announced for farmers interested in haying, free of charge, on almost 900 acres of Missouri State Parks lands. On Aug. 24, 2018, Governor Parson announced more than \$77,000 in state funding would be made available immediately to assist two water systems in the affected areas. Additional emergency funding of more than \$800,000 was committed for 10 eligible projects for which applications for assistance had been submitted.

Drought conditions reached their peak the week of Aug. 12, 2018, with 86 counties in D2 or greater drought status and nearly 98 percent of the state experiencing at least abnormally dry conditions (Fig.4). However, the weather pattern changed quickly over the next few weeks, with northern Missouri (the area most impacted by drought) receiving anywhere from 8-12 inches of rain from Aug. 14 to Sept. 26, 2018 (Fig. 5). A final DAC meeting was held Sept. 27, 2018. The committee heard information about short-term drought relief, but was also cautioned to continue monitoring the long-term hydrologic drought conditions that remained.

**U.S. Drought Monitor**  
**Missouri**

**August 14, 2018**  
*(Released Thursday, Aug. 16, 2018)*  
 Valid 8 a.m. EDT



**Figure 4. Missouri Drought Monitor Map for Aug. 14, 2018.**

By the time the Executive Order expired, Missouri had continued to see recovery from the drought. Guinan wrote in his October 2018 “Weather and Its Impacts on Missouri” report that October rain “... was the hydrological antidote to eliminate drought impacting the region for over a year. Some northern Missouri counties reported 20-25 inches of rain from mid-August to mid-October, which was similar to totals accumulated for 12-months prior to mid-August.”

As stated at the beginning of this report, Missouri’s drought of 2018 was notable in its localized intensities and its impacts to both agriculture and public water supplies. However, the 2018 drought should be remembered for the integrated response efforts. Governor Parson and his cabinet quickly responded with coordinated and effective resources. Agency staff worked tirelessly as a team with the goal of getting help to those who needed it most. Seamless communication also aided in the effective response. Communications staff from state agencies worked to ensure clear, coordinated information was communicated to the public.

## **2018 Drought Response Assessment Committee Member Representation**

Committee Lead:

Carol Comer, Director, Missouri Department of Natural Resources

Members:

Office of the Governor

Missouri Department of Agriculture

Missouri Department of Conservation

Missouri Department of Economic Development

Missouri Department of Health and Senior Services

Missouri Department of Public Safety

University of Missouri – College of Agriculture, Food and Natural Resources

University of Missouri – State Climatologist

Green Hills Regional Planning Commission

Harry S Truman Coordinating Council

Mark Twain Council of Governments

Mid-Missouri Regional Planning Commission

Northeast Missouri Regional Planning Commission

Pioneer Trails Regional Planning Commission

Southwest Missouri Council of Governments

National Oceanic and Atmospheric Administration

National Weather Service

U.S. Army Corps of Engineers

U.S. Department of Agriculture – Farm Services Agency

U.S. Department of Agriculture – Natural Resource Conservation Service

U.S. Department of Agriculture – Rural Development

U.S. Environmental Protection Agency, Region 7

U.S. Forest Service

U.S. Geological Survey

## **2018 Drought Response Agriculture Impact Team Member Representation**

Team Lead:

Kurt Boeckmann, Agriculture Liaison, Missouri Department of Natural Resources

Members:

Office of the Governor  
Missouri Department of Natural Resource – Soil and Water Conservation Program  
Missouri Department of Agriculture  
Missouri Department of Conservation  
Missouri Department of Transportation  
Lincoln University  
MFA Incorporated  
Missouri Cattlemen's Association  
Missouri Corn Growers Association  
Missouri Dairy Association  
Missouri Dairy Industry Alliance  
Missouri Egg Council  
Missouri Farm Bureau  
Missouri Pork Association  
Missouri Rural Water Association  
Missouri Soybean Association  
The Poultry Federation  
Soil and Water Districts Commission  
University of Missouri – College of Agriculture, Food, and Natural Resources  
U.S. Department of Agriculture – Natural Resources Conservation Service  
U.S. Department of Agriculture – Farm Service Agency

## 2018 Drought Response Agriculture Assistance

### Missouri Department of Natural Resources

#### Soil and Water Conservation Program

The Soil and Water Districts Commission approved practice policy variances for several practices and created a new practice in response to the Governor's Executive Order 18-05. The Department of Natural Resources also required all districts to move landowners completing a drought-related practice to the top of their waiting lists. **Overall, 68 districts developed 3,165 contracts that provided \$8,153,942.** Variances approved by the Soil and Water Districts Commission include the following:

- Cover Crop Practice: The Soil and Water Districts Commission allowed haying of cover crops statewide to provide for much needed forage production. In counties that were designated as a D2 drought level or higher, the Soil and Water Districts Commission waived the requirement that the production crop must be a minimum two crop rotation, and increased the lifetime maximum amount a landowner can receive for the cover crop practice from \$20,000 to \$30,000. **There were 3,092 contracts developed that provided \$7,839,926 for cover crops.**
- Grazing Systems: The Soil and Water Districts Commission deferred the grazing school requirement in counties designated as D2 drought level or higher for 12 months. If a landowner had not attended a grazing school, the soil and water conservation district was allowed to develop a contract for water development (well), water distribution (pipeline and tank) to supply water to one tank and fencing (for subdividing pastures for rotational grazing to improve forage supply). After the landowner attends grazing school, the development of their entire grazing system can be completed. **There were 66 grazing contracts developed that provided \$292,911.**
- Pond Cleanout: The Soil and Water Districts Commission created a new practice to remove sediment from ponds that were constructed with state cost-share assistance in counties designated as D2 drought level or higher. Cost-share assistance is based on the acres of the pool that had sediment removed. District staff calculated the increase of the water storage volume, which will be reported after all practices are completed. **There were seven contracts developed that provided \$21,105 for the pond cleanout practice.**
- Grazing in Livestock Exclusion Areas: The Soil and Water Districts Commission granted a variance statewide that allowed livestock to graze in excluded areas for six additional state cost-share practices.

#### Division of State Parks

On Aug. 20, 2018, Governor Parson announced the availability of water for family farms at 28 Department of Conservation areas and five Department of Natural Resources' state parks. Governor Parson also announced the creation of a lottery for farmers interested in haying, free of charge, on almost 900 acres of Missouri State Parks lands. The lottery for haying at Missouri State Parks opened August 20 and closed August 27, which provided time to view available

acres before applying. The Department of Natural Resources announced lottery results Aug. 27, 2018.

### **Missouri Department of Conservation**

On August 20, Governor Parson announced availability of water from state parks and Missouri Department of Conservation (MDC) Areas. As many as 5,000 gallons of water could be pumped daily, per family farm. Water was available for livestock needs only and not for resale. Farmers would need to provide their own pumping and hauling equipment. Missouri Department of Conservation provided assistance for landowners who wanted to locate water sources. One permit for water pumping was made at Bonanza Conservation Area where a local farmer pumped water for several days for her livestock. MDC also allowed haying on 474 acres of Conservation Area land.

### **Missouri Department of Agriculture**

Missouri Department of Agriculture's (MDA) primary role in drought relief efforts was to direct farmers and ranchers to agencies with technical resources. MDA used online distribution and social media platforms to engage producers and share updates. In total, MDA generated more than 818,000 impressions (not people) on drought-related content.

MDA maintains an online Hay Directory to serve as a resource for farmers looking to sell or purchase hay. With the tight supply of hay this summer, more producers sought out the Hay Directory and page views increased 400 percent from the same period in 2017. MDA updated the online Hay Directory and changed the format to become more user friendly by prominently displaying links to neighboring states' directories and providing information about importing hay from fire ant quarantine areas.

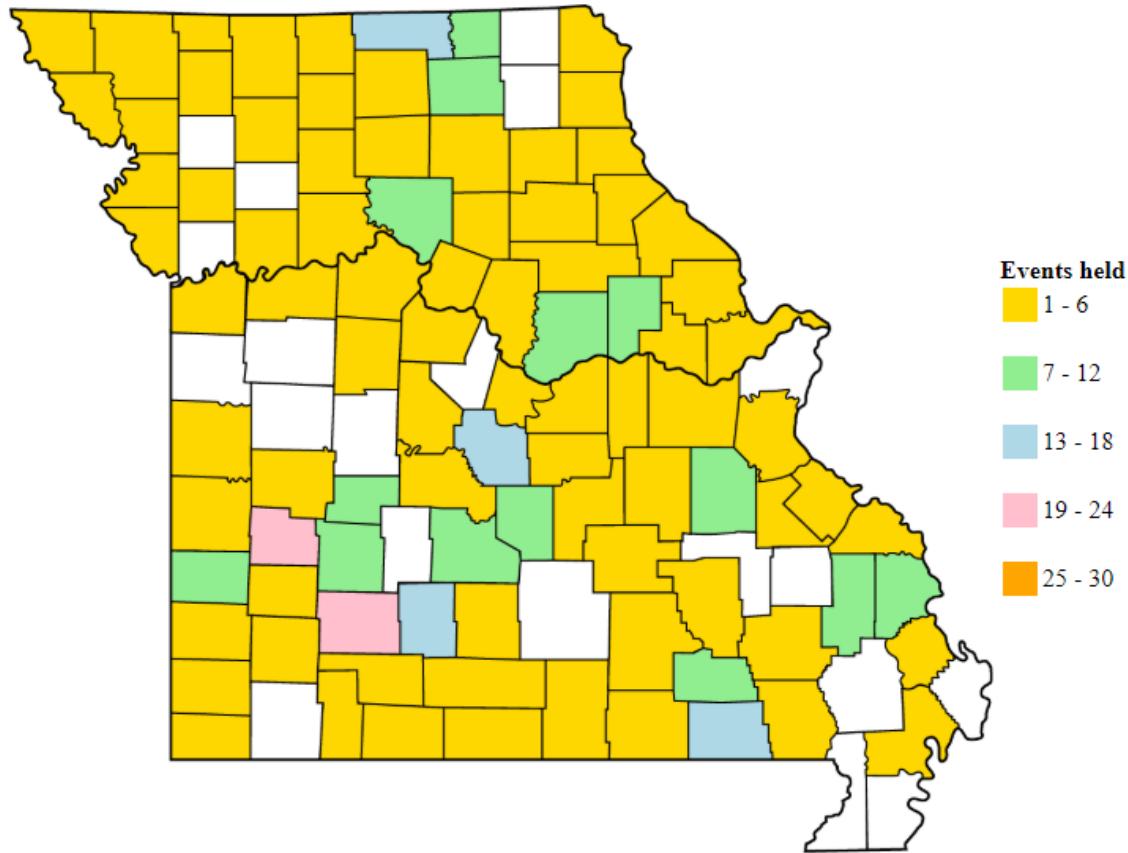
### **Missouri Department of Transportation**

On Aug. 7, 2018, Missouri Department of Transportation issued a special over-width blanket permit for the transportation of hay to assist in the statewide drought relief efforts. This permit authorized movements to be made at night and on holidays at no cost to all transporters. Over-width transportation during the nighttime hours and on holidays is prohibited, so removing these restrictions provided considerable scheduling and logistical relief for the agricultural community. During the special permit waiver period that expired Oct. 31, 2018, 93 blanket permits were issued to 56 different transporters. In addition to the special blanket permits, an additional 11 single-trip permits were issued to 10 different transporters during this period.

### **University of Missouri**

#### Extension Program

Extension Specialists throughout the state hosted more than 40 workshops specifically for the purpose of addressing drought issues relating to forages and beef production. More than 19,000 adults were reached at a combined total of 394 events where drought response was discussed (Fig. 1). Topics addressed included: household water supplies, livestock and crop water, irrigation strategies, water conservation, culling herds and herd management, hay and forage production, locating hay and more.



**Figure 1. MU-Extension Program events held by county during the 2018 drought.**

#### Missouri Climate Center

The Missouri Climate Center worked closely with the National Drought Mitigation Center to ensure the state was hearing from local citizens about impacts being felt around the state. The Missouri Climate Center set up a Missouri-specific drought impact report site, which streamlined users' effort to submit a report. For reports submitted nationally between April 2 and December 1, 2018, Missouri's reports comprised 65 percent of the total. Between May 11 and October 23, 2018, Missourians submitted 1,488 reports accompanied by nearly 200 photos.

#### **U.S. Department of Agriculture, Natural Resources Conservation Service**

##### Environmental Quality Incentive Program

On July 18, Natural Resources Conservation Service (NRCS) announced \$2 million available to help Missouri farmers plant cover crops to address inadequate feed, forage and other natural resource concerns resulting from the drought. Cover crops established under this emergency initiative could be grazed or hayed. This differed from existing Environmental Quality Incentive Program cover crop contracts, which only allow grazing. NRCS received 1,525 applications from landowners in counties with drought conditions listed in the U.S. Drought Monitor Report as "extreme." The 1,525 applications involved more than 206,000 acres and would have required \$13,400,000 to fund them all. Missouri NRCS was able to secure an additional \$2 million from the national office. The additional \$2 million brought total assistance to more than \$4 million, which funded 489 contracts to provide cover crops on approximately 66,000 acres.

### Wetland Reserve Easement

On July 23, NRCS announced it would allow landowners to cut hay on up to 50 percent of the grassy areas within their wetland easements located in counties experiencing severe or extreme drought. NRCS initially estimated 10,000 acres would be eligible for haying. On Aug. 7, NRCS expanded the eligible area of easements that could be hayed to all of Missouri. Letters were sent to more than 1,100 wetland reserve easement landowners throughout Missouri, notifying them about the haying increase. With the increased eligibility, NRCS estimated more than 15,000 acres of grassy areas within wetland easements were eligible for haying.

### **U.S. Department of Agriculture Farm Service Agency**

Farm Service Agency (FSA) offers disaster assistance and low-interest loan programs to assist agricultural producers in their recovery efforts during drought or similar qualifying natural disasters. Available programs and loans for Missouri producers due to drought in 2018 included the following:

#### Livestock Forage Disaster Program

The Livestock Forage Disaster Program (LFP) provided compensation to eligible livestock producers who suffered grazing losses for covered livestock due to drought on privately owned or cash leased land. To qualify, a county must have been rated D2 intensity by the U.S. Drought Monitor in any area of the county for at least eight consecutive weeks, or D3 intensity in any area of the county at any time during the normal grazing period. The following 61 counties in Missouri were eligible for LFP:

Adair, Andrew, Atchison, Audrain, Barry, Barton, Boone, Buchanan, Caldwell, Callaway, Carroll, Cass, Cedar, Chariton, Clark, Clay, Clinton, Cole, Cooper, Dade, Dallas, Daviess, DeKalb, Gentry, Greene, Grundy, Harrison, Hickory, Holt, Howard, Jackson, Jasper, Johnson, Knox, Laclede, Lafayette, Lawrence, Lewis, Linn, Livingston, Macon, McDonald, Mercer, Moniteau, Monroe, Morgan, Newton, Nodaway, Platte, Polk, Putnam, Randolph, Ray, Saline, Schuyler, Scotland, St. Clair, Sullivan, Webster, Worth, Wright.

#### Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish Program

The Emergency Assistance for Livestock, Honeybees, and Farm-Raised Fish Program provides emergency relief for losses due to feed or water shortages, disease, adverse weather or other conditions, which were not adequately addressed by other disaster programs. The following 61 counties in Missouri were eligible for ELAP for water hauling:

Adair, Andrew, Atchison, Audrain, Barry, Barton, Boone, Buchanan, Caldwell, Callaway, Carroll, Cass, Cedar, Chariton, Clark, Clay, Clinton, Cole, Cooper, Dade, Dallas, Daviess, DeKalb, Gentry, Greene, Grundy, Harrison, Hickory, Holt, Howard, Jackson, Jasper, Johnson, Knox, Laclede, Lafayette, Lawrence, Lewis, Linn, Livingston, Macon, McDonald, Mercer, Moniteau, Monroe, Morgan, Newton, Nodaway, Platte, Polk, Putnam, Randolph, Ray, Saline, Schuyler, Scotland, St. Clair, Sullivan, Webster, Worth, Wright.

#### Emergency Loan Program

The Emergency Loan Program was available to producers with agricultural operations located in a county under a primary or contiguous Secretarial Disaster designation. These low interest loans

help producers recover from production and physical losses. All counties in Missouri were designated as either primary or contiguous counties. Therefore, all counties were eligible for emergency loans.

#### Non-Insured Crop Disaster Assistance Program

The Non-Insured Crop Disaster Assistance Program (NAP) provided financial assistance to producers of non-insurable crops when low yields, loss of inventory, or prevented planting occur due to natural disasters (includes native grass for grazing). Eligible producers must have purchased NAP coverage for 2018 crops.

#### Emergency Conservation Program

The Emergency Conservation Program (ECP) provides emergency funding for farmers and ranchers to rehabilitate land severely damaged by natural disasters and to implement emergency water conservation measures in periods of severe drought. It was estimated around \$2 million will be disbursed through this program once all payments have been completed. In Missouri, 32 counties were approved for ECP Drought, as follows:

- **Approved June 6, 2018** – Caldwell, DeKalb, Daviess, Holt.
- **Approved July 5, 2018** – Andrew, Grundy, Harrison, Livingston, Nodaway, Putnam, Schuyler, Sullivan.
- **Approved July 20, 2018** – Adair, Carroll, Chariton, Clay, Cole, Gentry, Linn, Mercer, Ray, Worth.
- **Approved Aug, 1, 2018** – Buchanan, Clinton.
- **Approved Aug, 8, 2018** – Callaway, Howard.
- **Approved Aug, 17, 2018** – Boone, Cooper.
- **Approved Aug, 17, 2018** – Lawrence, Scotland (No recipients, as program was shut down before sign-up period ended, due to receiving rainfall.).
- **Approved Aug, 23, 2018** – Polk, Dallas (No recipients, as program was shut down before sign-up period ended, due to receiving rainfall.).

#### HayNet Service

HayNet is a web-based Hay and Grazing Net Ad Service allowing farmers and ranchers to share “Need Hay” and “Have Hay” ads online. Farmers used HayNet for these purposes as well as for posting advertisements for grazing land.

#### Conservation Reserve Program Emergency Haying and Grazing Component

The Emergency Haying and Grazing component of the Conservation Reserve Program (CRP) was authorized to provide relief to livestock producers on CRP acres affected by a severe drought or similar natural disaster. Emergency authorization is provided by either a national FSA office authorization or by a state FSA committee determination utilizing the U.S. Drought Monitor. In Missouri, 58 counties received emergency haying and grazing approval, as follows:

- **Approved July 16, 2018** – Adair, Andrew, Audrain, Barry, Barton, Boone, Buchanan, Caldwell, Callaway, Carroll, Chariton, Clark, Clay, Clinton, Cole, Cooper, Dade, Daviess, DeKalb, Gentry, Grundy, Harrison, Howard, Jackson, Jasper, Knox, Lafayette, Lawrence, Lewis, Linn, Livingston, Macon, Mercer, Moniteau, Monroe, Nodaway, Platte, Putnam, Randolph, Ray, Saline, Schuyler, Scotland, Sullivan, Worth.
- **Approved July 19, 2018** – Atchison, Holt, Vernon.

- **Approved July 26, 2018** – Pettis.
- **Approved July 31, 2018** – Cedar, Warren.
- **Approved Aug. 3, 2018** – Cass, Marion.
- **Approved Aug. 9, 2018** – Dallas, Montgomery, Polk, Ralls, Shelby.

## **2018 Drought Response Water Supply Impact Team Member Representation**

Team Lead:

David Lamb, Chief, Public Drinking Water Branch, Missouri Department of Natural Resources

Members:

Office of the Governor

Missouri Department of Natural Resources – Financial Assistance Center

Missouri Department of Natural Resources – Public Drinking Water Branch

Missouri Department of Natural Resources – Water Resources Center

Missouri Department of Natural Resources – Kansas City Regional Office

Missouri Department of Natural Resources – Northeast Regional Office

Missouri Department of Conservation

Missouri Department of Economic Development

Missouri Department of Health and Senior Services

City of Cameron

City of Hamilton

Green Hills Regional Planning Commission

Missouri American Water

Missouri Rural Water Association

North Central Missouri Regional Water Commission

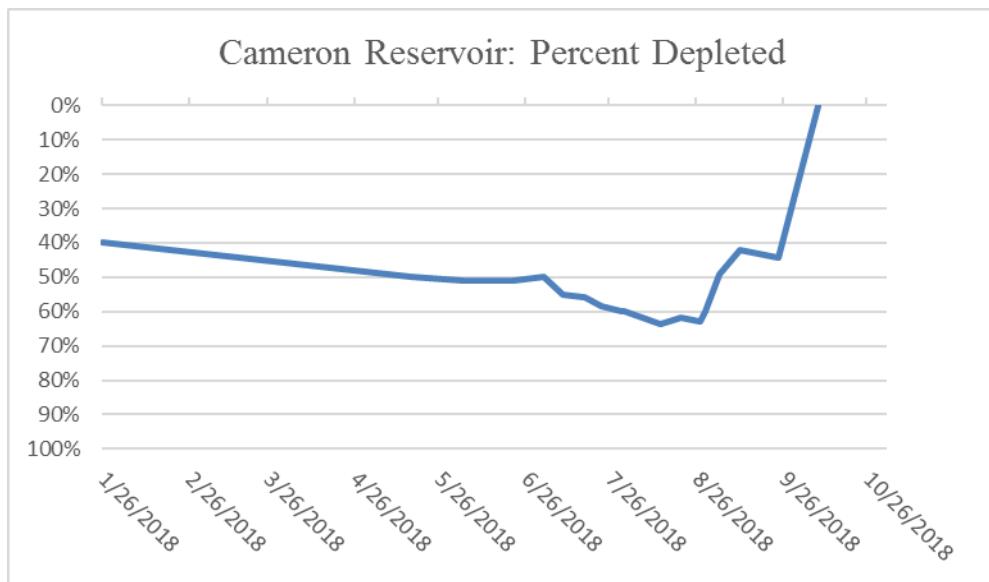
U.S. Department of Agriculture – Rural Development

U.S. Environmental Protection Agency

## 2018 Drought Response Water Supply Impacts

### Cameron, Missouri

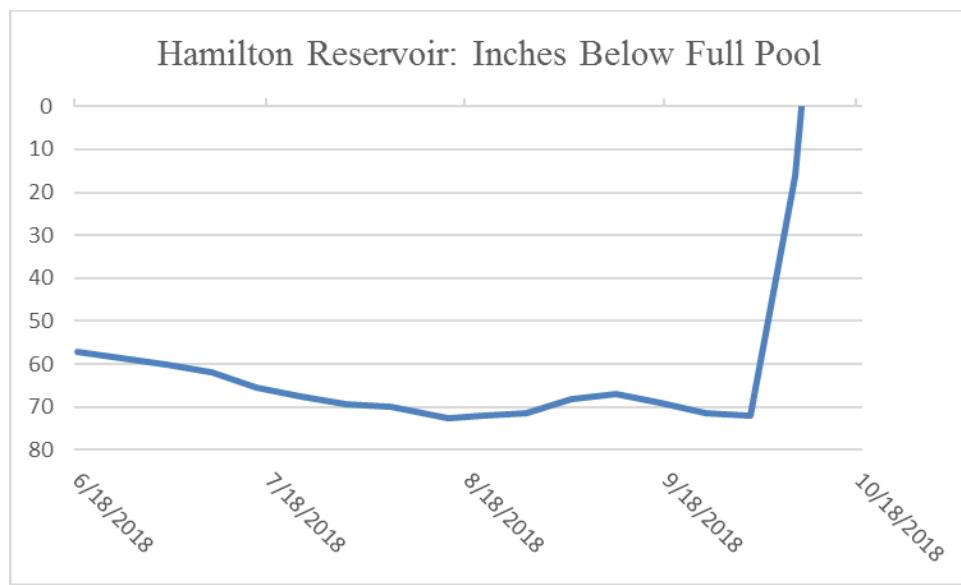
The city of Cameron, Missouri, uses a series of reservoirs to provide drinking water to more than 9,900 customers and Clinton County Public Water Supply District No. 3. Between May 2017 and late August 2018, raw water capacity in the city's reservoir system declined to 36.5 percent. Based on water usage, approximately 159 days of raw water was available. Cameron has a local ordinance to address potential water shortage supplies that includes three phases, a water shortage advisory (voluntary water conservation), a water shortage alert (voluntary water conservation and restrictions on non-domestic or non-essential water use), and a water shortage emergency (voluntary and mandatory water conservation with an emergency rate structure to incentivize water conservation). The advisory phase was implemented as early as January 2018 (with the reservoir system at 60 percent capacity) and upgraded to the alert phase in May (with the reservoir system at 50 percent capacity). By August, the city council declared a water shortage emergency since the reservoir capacity dropped below 40 percent capacity.



In response to extended dry conditions, Cameron's city council adopted a resolution in July to develop a contract to draw up to 270 million gallons of water from the Missouri Department of Conservation's Pony Express Lake through an emergency, temporary above ground transmission line. The Department of Natural Resources' Public Drinking Water Branch authorized an emergency waiver request to construct and use the temporary line in July. The line was functional by October 3, 2018. With the temporary line activated and substantial precipitation in late September and early October, the reservoir returned to full pool by October 8 and the city rescinded all emergency conservation measures. To address long-term drought resilience, the city of Cameron and other communities in northwest Missouri are collaborating to develop a regional water distribution network. Although this regional network is several years from completion, once complete, it will greatly enhance drought resilience for all communities in northwest Missouri.

## Hamilton, Missouri

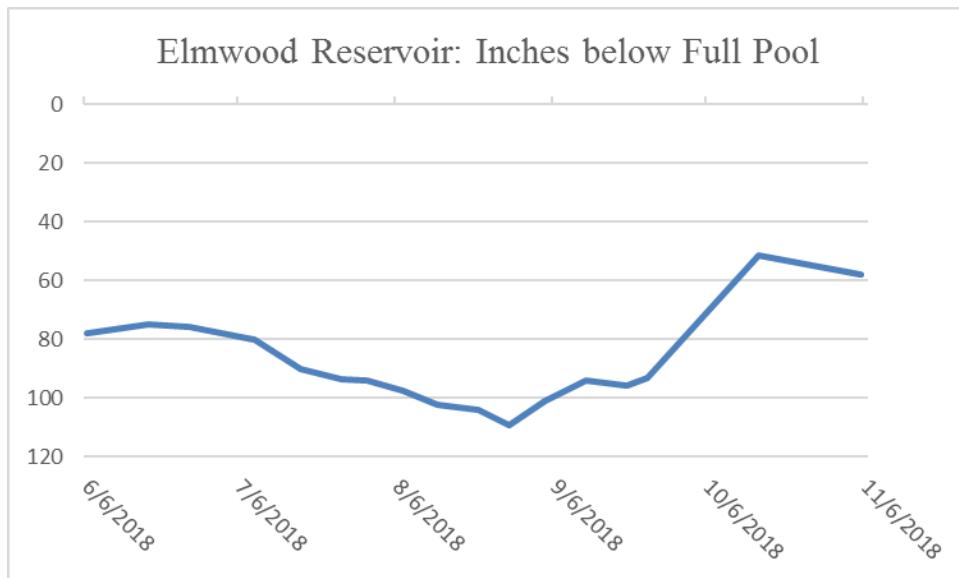
The city of Hamilton, Missouri, uses the Hamilton Reservoir as its primary source of raw water and serves more than 1,800 people. Throughout the drought, Hamilton was the sole provider of water to Caldwell County Public Water Supply District No. 2, which serves the region in and around Kidder, Missouri. By June 2018, the reservoir was 57 inches below full pool, and dropped to 72.75 inches below full pool by mid-August. Like the city of Cameron, the city of Hamilton has a three-stage water conservation ordinance to address water shortages. Stage I (voluntary) conservation measures are implemented when the reservoir reaches 36 inches below full pool. Stage II conservation measures, which include mandatory water use restrictions, are implemented when the reservoir reaches 48 inches below full pool. Stage III conservation measures, which may include a variety of enforceable restrictions imposed by the city's Board of Aldermen, are implemented when the reservoir's water level drops below the city's fixed water intake (approximately 95 inches below full pool). By mid-June, the city implemented Stage II water conservation measures and by mid-August, reservoir levels were less than two feet above the fixed intake. In addition to water quantity concerns, city staff observed an increase in manganese and hydrogen sulfide in raw water, due to very low water levels in the reservoir, a factor that further complicated the city's efforts to provide water. During the most severe portion of the drought, Hamilton was reporting a drop of 4 inches per day in reservoir levels. As with the city of Cameron, the city of Hamilton received significant precipitation in early October that returned the reservoir to full pool by October 9, at which time the city rescinded all conservation measures.



Prior to October, the city explored both short- and long-term options to acquire additional raw water, with assistance from private consultants and Department of Natural Resources staff. A project partially funded by the Department of Natural Resources to construct an emergency interconnection to Caldwell County Public Water Supply District No. 3 is currently under review and development. Caldwell County Public Water Supply District No. 2 is engaged in a similar project to develop an emergency connection to Daviess County Public Water Supply District No. 2.

## North Central Missouri Regional Water Commission (Milan, Missouri)

The North Central Missouri Regional Water Commission (NCMRWC) serves almost 7,000 people through wholesale water sales to the cities of Milan, Green City and Sullivan County Public Water Supply District No. 1, which serves most of Sullivan County. Elmwood Reservoir is the primary source of raw water for the NCMRWC and for the Smithfield Fresh Meats Corporation. As with Cameron and Hamilton, prolonged drought severely impacted raw water storage in Elmwood Reservoir, and by mid-June, the reservoir was 78 inches below full pool. NCMRWC responded by requesting voluntary water conservation measures from consumers. However, by the end of August water levels dropped to 109.5 inches below full pool as drought conditions persisted. Significant precipitation in early October improved water levels in the reservoir, but not as dramatically as for Cameron and Hamilton. By mid-October, water levels rebounded to 51.5 inches below full pool. As of November 5, 2018, levels dropped to 58 inches below full pool. The voluntary conservation measures implemented by the system are to remain in place until the reservoir reaches 48 inches (or less) below full pool.



NCMRWC can divert water into their reservoir system from Locust Creek when stream flow is adequate, but the creek had little flow throughout the drought. The rain event in early October, although it did not fully replenish Elmwood Reservoir, did allow NCMRWC to pump from Locust Creek for approximately 20 days. An emergency transmission line extends close to 30 miles from the City of Trenton to Sullivan County Public Water System No. 1, but flow through this line is not optimized and various upgrades are needed to maximize flow. A portion of the emergency assistance provided to drought-impacted systems by the Department of Natural Resources is being directed toward optimization of the Trenton line. This project and several other collaborative projects are in development to further improve drought resilience in north central Missouri. The East Locust Creek Reservoir project, currently in development, will further increase drought resilience in this region.

## **Circuit Rider Leak Detection Assistance**

The Department of Natural Resources' Public Drinking Water Branch administers a drinking water assistance contract with Missouri Rural Water Association (MRWA) as part of its capacity development program. The contract provides onsite technical, managerial and financial assistance and training to water system staff. Although not specifically designed for emergency response or operations, services provided by MRWA through this contract assisted several communities in northwest Missouri struggling with drought, including the city of Hamilton and Daviess County Public Water Supply District No. 1. During the hottest and driest portion of the drought, the Hamilton Reservoir was declining as much as 4 inches per day. Leak detection is a popular contract service and can help systems like Hamilton mitigate drought impacts by reducing lost water. In early August, the communities of Altamont, Weatherby and Winston, all served water by Daviess County Public Water Supply District No. 1, experienced water shortages. With assistance from MRWA and contract circuit riders, a variety of issues were identified including failed or failing pumps and water main blockages. Over a five day period, 2 miles of water main were cleared and service was restored.

## **Drought Response and Resilience Publications**

The Department of Natural Resources' Public Drinking Water Branch routinely offers guidance to regulated public water systems about various technical, managerial and financial matters. In order to proactively mitigate effects of future droughts, three publications are in development. The first is a publication intended for the general public that promotes common water conservation practices. The second is for public water systems that provides information about the signs of water loss. The third is a detailed, technical publication also for public water systems that describes common drought impacts to surface and groundwater sources, system infrastructure, and treatment techniques. Additionally, this publication emphasizes the importance of communication to the public during episodes of drought. It also provides guidance about how public water systems can better prepare, plan and respond when drought conditions exist.

## **2018 Drought Response Emergency Financial Assistance for Public Water Systems**

The Missouri Department of Natural Resources made emergency grant and loan funds available for community water systems within counties designated as drought alert areas by Executive Order 18-05. Eligible applicants included publicly-owned community water systems serving fewer than 10,000 people. To be eligible, projects needed to be necessary to abate drought-related, emergency conditions that disrupted water system operations and required immediate action in order to ensure an adequate supply of safe drinking water to the service area. Projects included construction projects for system repairs, replacement or improvement of failed or inadequate infrastructure, construction of a temporary or permanent connection to another viable source of water, or construction intended to improve system capacity.

The Department of Natural Resources' Water Protection Program received 21 applications for emergency financial assistance between July 25 and August 17. Requested loan funds totaled \$1 million and requested grant funds totaled \$3,516,268. The Water Protection Program coordinated with other funding agencies, including U.S. Department of Agriculture and Missouri Department of Economic Development, through weekly calls and numerous ad hoc discussions to leverage funding with partners and ensure there was no duplication of benefit.

The program evaluated each of the 21 applications to determine if they would address an immediate need caused by drought, and communicated with partners and applicants regarding eligibility. The following determinations were made regarding emergency funding eligibility:

- One application for maintenance was determined to not be eligible.
- Ten applications were determined to be for projects that increase resiliency but did not meet the criteria for emergency funding because the project scope and proposed timeline would not make an immediate impact during this drought. These applicants were referred to non-emergency financial assistance opportunities, including the Department of Natural Resources' Drinking Water State Revolving Fund or to U.S. Department of Agriculture's Rural Development programs, and the Missouri Department of Economic Development's Community Development Block Grant.
- Ten applications were determined to be eligible projects that would provide drought relief totaling \$912,568. Of the 10 that received Department of Natural Resources' emergency grants, eight are being co-funded with Missouri Department of Economic Development's Community Development Block Grants, totaling \$2,678,608. Drought emergency grant commitment notifications were made to the 10 applicants. Several projects are complete and fully reimbursed while others still are in design.

## **2018 Drought Response Communications**

State agency staff worked tirelessly as a team with a goal of getting help to those who needed it most. Seamless communication aided in the effective response throughout the drought. Communications staff from state agencies worked to ensure clear, coordinated information was available and communicated. Along with personal interaction with the public and media, critical information was shared using social media platforms and websites administered by the Governor's Office and Departments of Natural Resources, Agriculture and Conservation. The Department of Natural Resources' drought website served as the central point for information dissemination. It is located at [dnr.mo.gov/drought.htm](http://dnr.mo.gov/drought.htm).

Social media platforms and website totals:

- 1 million – The number of interactions on state social media sites.
- 634,106 – The number of Facebook impressions.
- 271,679 – The number of Twitter impressions.
- 110,000 – The number of hits on state webpages to include Departments of Natural Resources, Agriculture and Conservation.
- 46,910 – The number of GovDelivery Eblast opens.
- 777 – The number of Instagram impressions.
- 711 – The number of news release hits, among 21 news releases distributed by Governor Parson and the Department of Natural Resources.